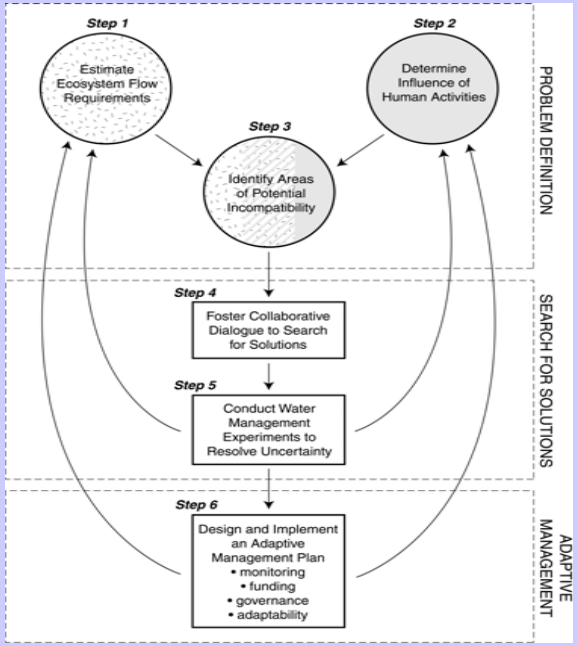
The Nature Conservancy

SAVING THE LAST GREAT PLACES ON EARTH

The Challenge of Interstate Flow Management:



The Delaware Basin's Efforts Towards Ecologically Sustainable Use and Water Supply

Colin Apse, The Nature Conservancy, Eastern U.S. Freshwater Program

Carol Collier, Delaware River Basin Commission, Executive Director

USGS Conference on "Linking hydrological change and ecological response in streams and rivers of the eastern United States"

February 8, 2005

Ecologically Sustainable Water Management in the Delaware

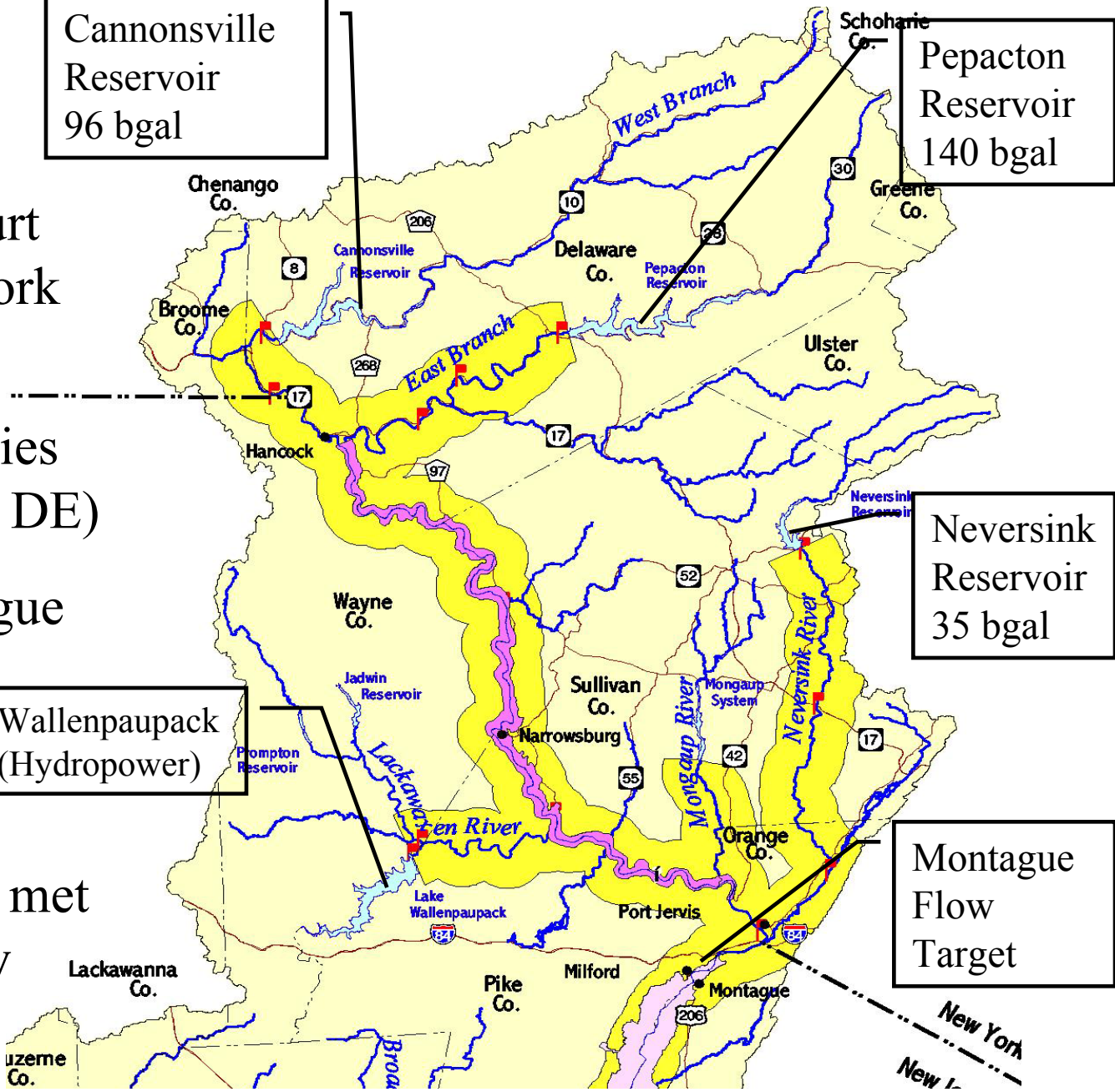
- Delaware flow management contentious: DRBC recognition that a series of flow management issues needed resolution due to changing values and information
- TNC has worked with many water managers and has a nationwide agreement with Corps on improving dam management
- TNC and DRBC involvement in Delaware flow issues focused on finding a balance between broadly defined human and ecological needs

Ecologically Sustainable Water Management in the Delaware

- Delaware River Basin Commission, created in 1961 through a federal-interstate Compact, provides both water management oversight and a venue for interstate negotiations
- Both DRBC and the states are seeking ecological science to inform future water allocation decisions and current water management rules
- Interstate flow management provides unique opportunity to have regional impacts, yet political hurdles remain significant

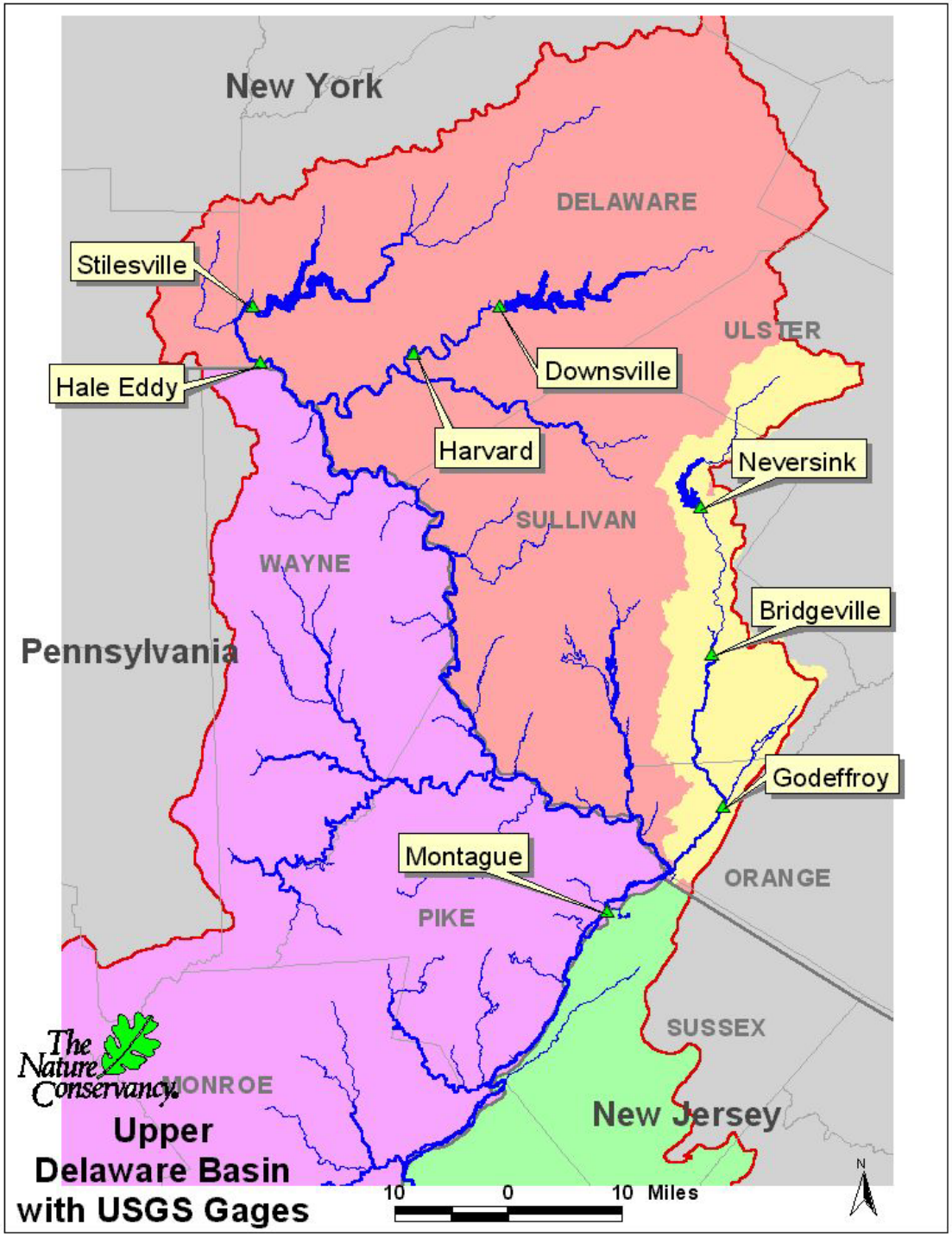
Upper Delaware: The Basin Rules

- 1954 Supreme Court Decree Set Framework
- Changes must be approved by all Parties (NYC, NY, PA, NJ, DE)
- 1750 cfs at Montague (3000 at Trenton) enforced by River Master
- Flow target can be met by releases from any reservoir



Upper Delaware: The Basin Rules

- Conservation releases from all reservoirs (.1 to .35 cfs/square mile in normal; less than 1 day pre-dam min. in drought)
- Montague target, conservation releases, and NYC diversion progressively decrease during drought
- Thermal "bank" has been used to maintain temperatures in coldwater sections for trout populations

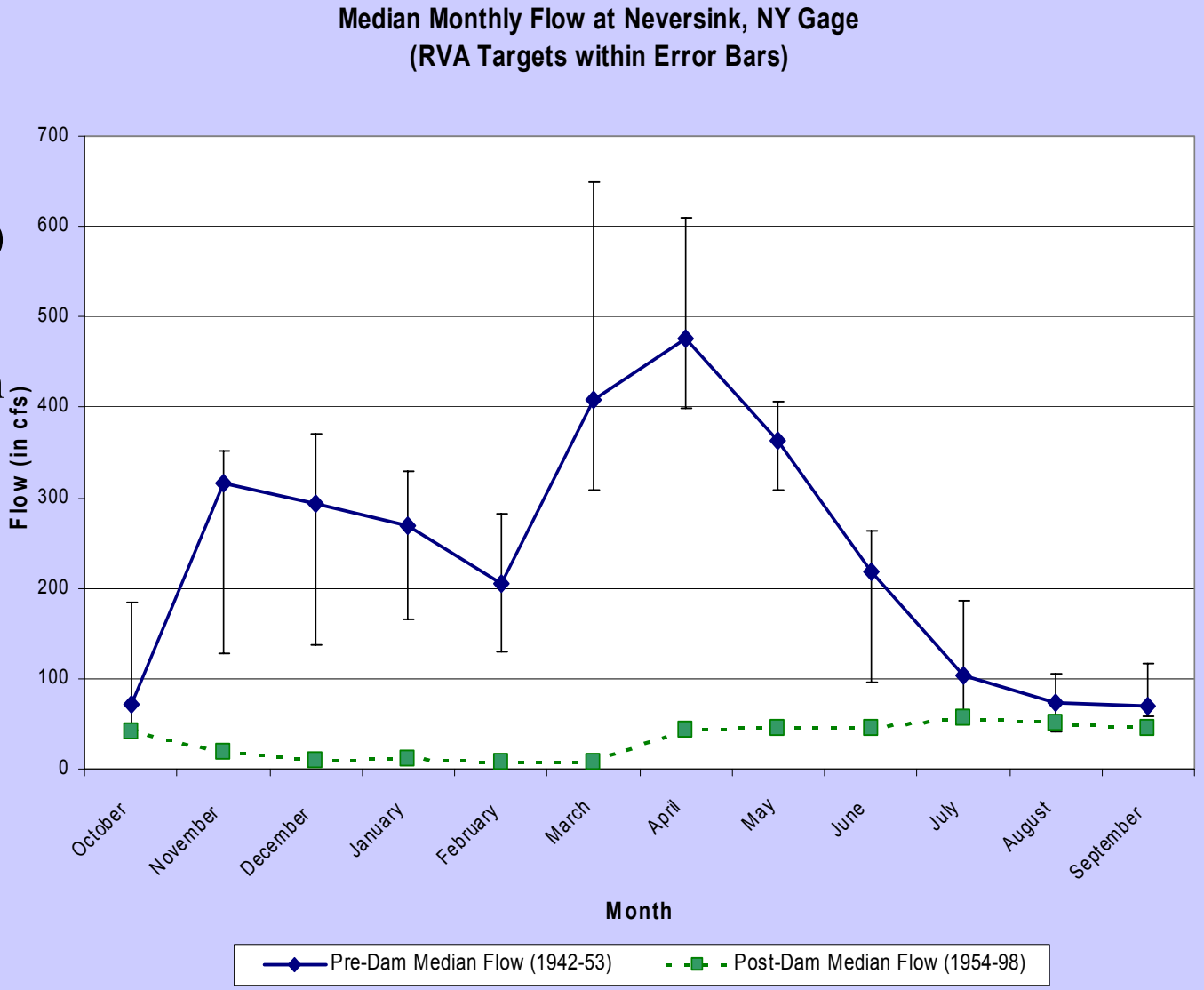


Upper Delaware: Ecological Profile

- Connectivity to ocean: significant diadromous fish migrations and spawning
- Substantial trout populations in tailwaters and upper mainstem
- Mussel community includes federally endangered dwarf wedgemussel: variety of host fish
- Riparian community increasingly impacted by Japanese knotweed

Flow Alteration in the Upper Delaware

- Typical NYC diversion of over 50% at the 3 reservoirs: 250 bgal annual avg
- Heaviest % diversion from Neversink
- Primary summer/fall releases for Montague from Cannonsville (lowest water quality)
- Flow parameters broadly impacted: particularly monthly magnitude, min flow duration, high pulse freq, etc. (from IHA7)

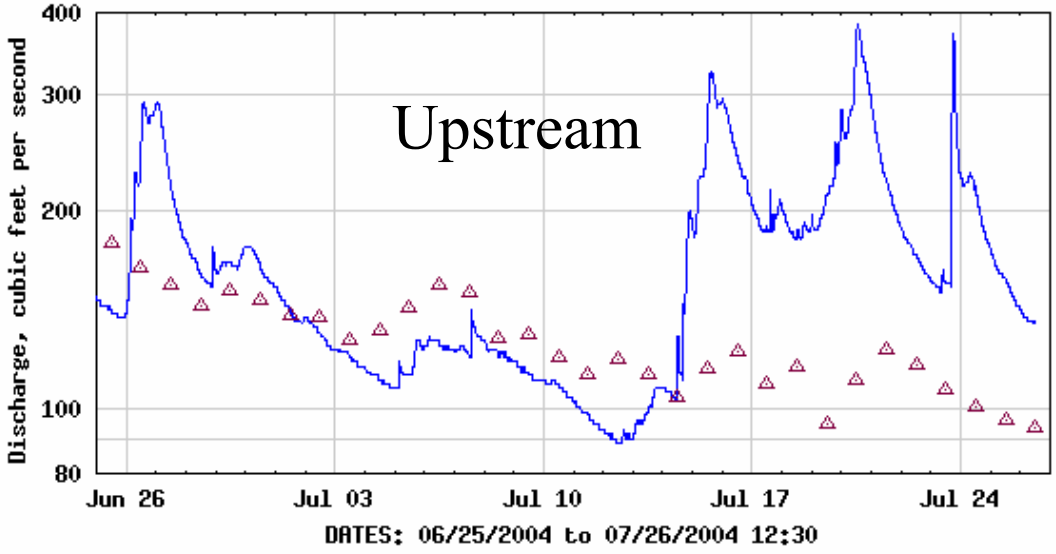


Rate of Change in Flow

- Rapid flow changes can lead to strandings and other impacts
- Rapid changes to meet Montague target and temps
- Most drastic changes associated with poor precipitation forecasts

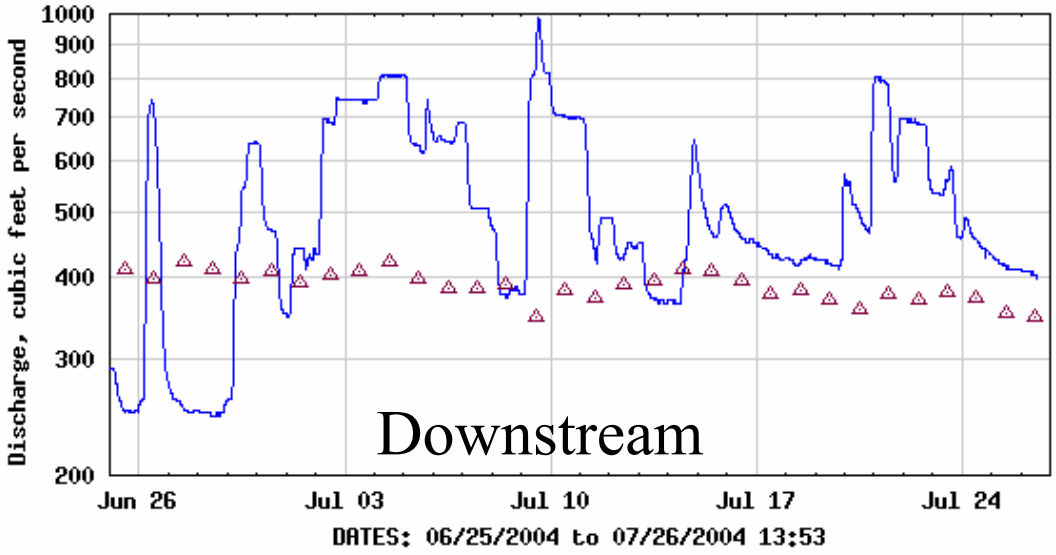
USGS

USGS 01423000 WEST BRANCH DELAWARE RIVER AT WALTON NY



USGS

USGS 01426500 WEST BRANCH DELAWARE RIVER AT HALE EDDY NY

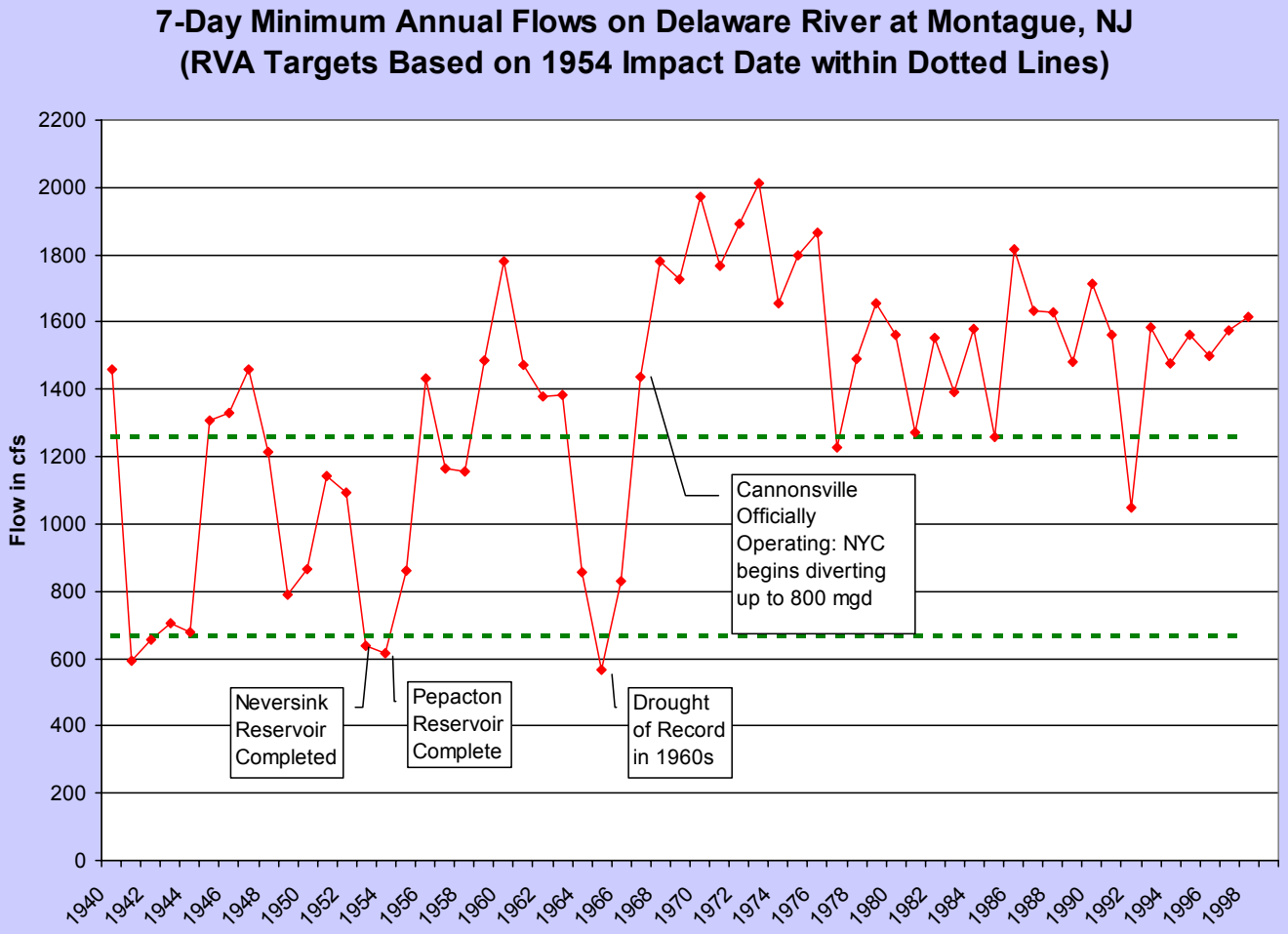


EXPLANATION

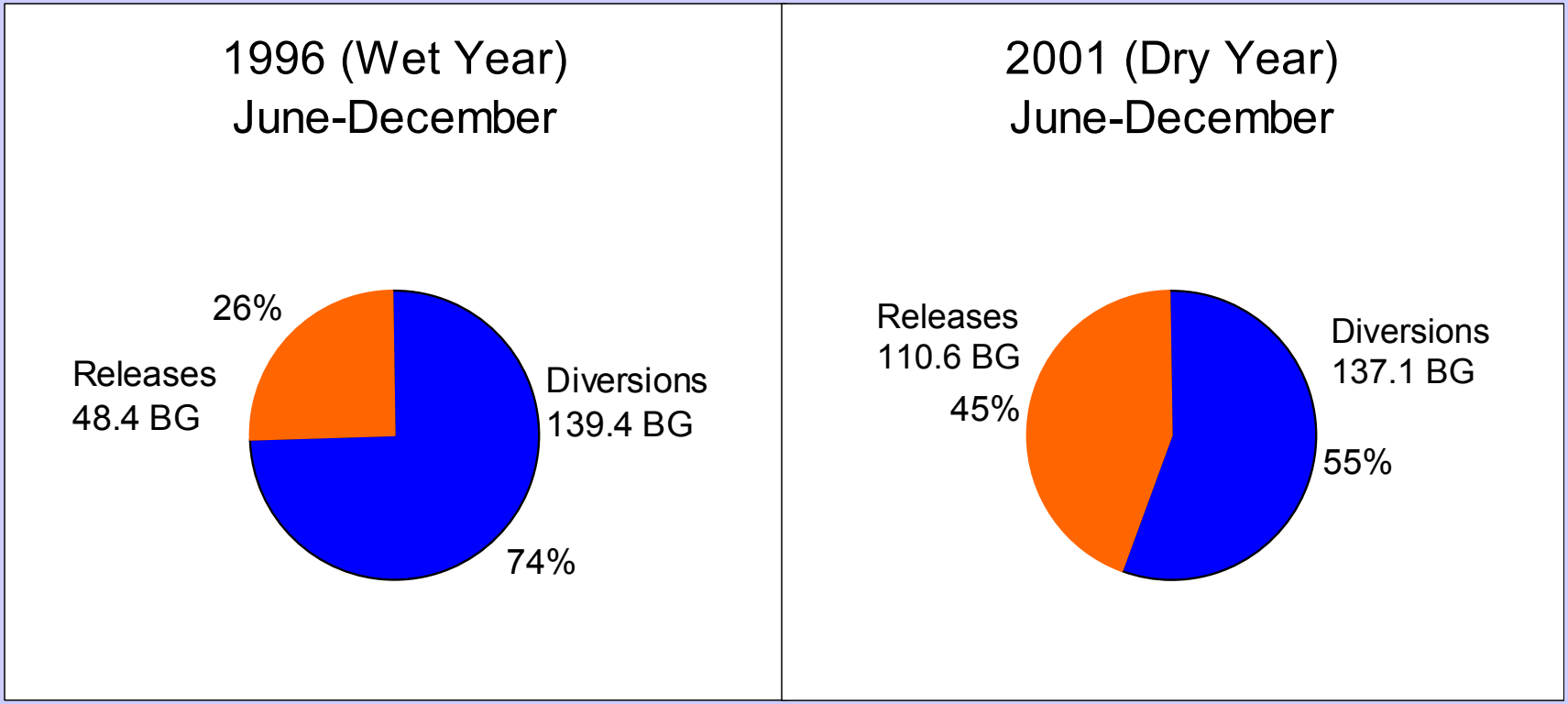
DISCHARGE

Opportunity for Change

- Montague flow target artificially elevates low flows
- Water quality differential narrowing
- Substantial inefficiencies associated with meeting seasonally constant daily flow target downstream



Examples of Distribution of Diversions and Releases from the NYC Reservoirs



The distribution of diversions and releases from the NYC reservoirs varies, under existing operating rules, between the extremes shown .

Source of data: U.S. Geological Survey – Office of Delaware River Master

Problem Recognition and Action

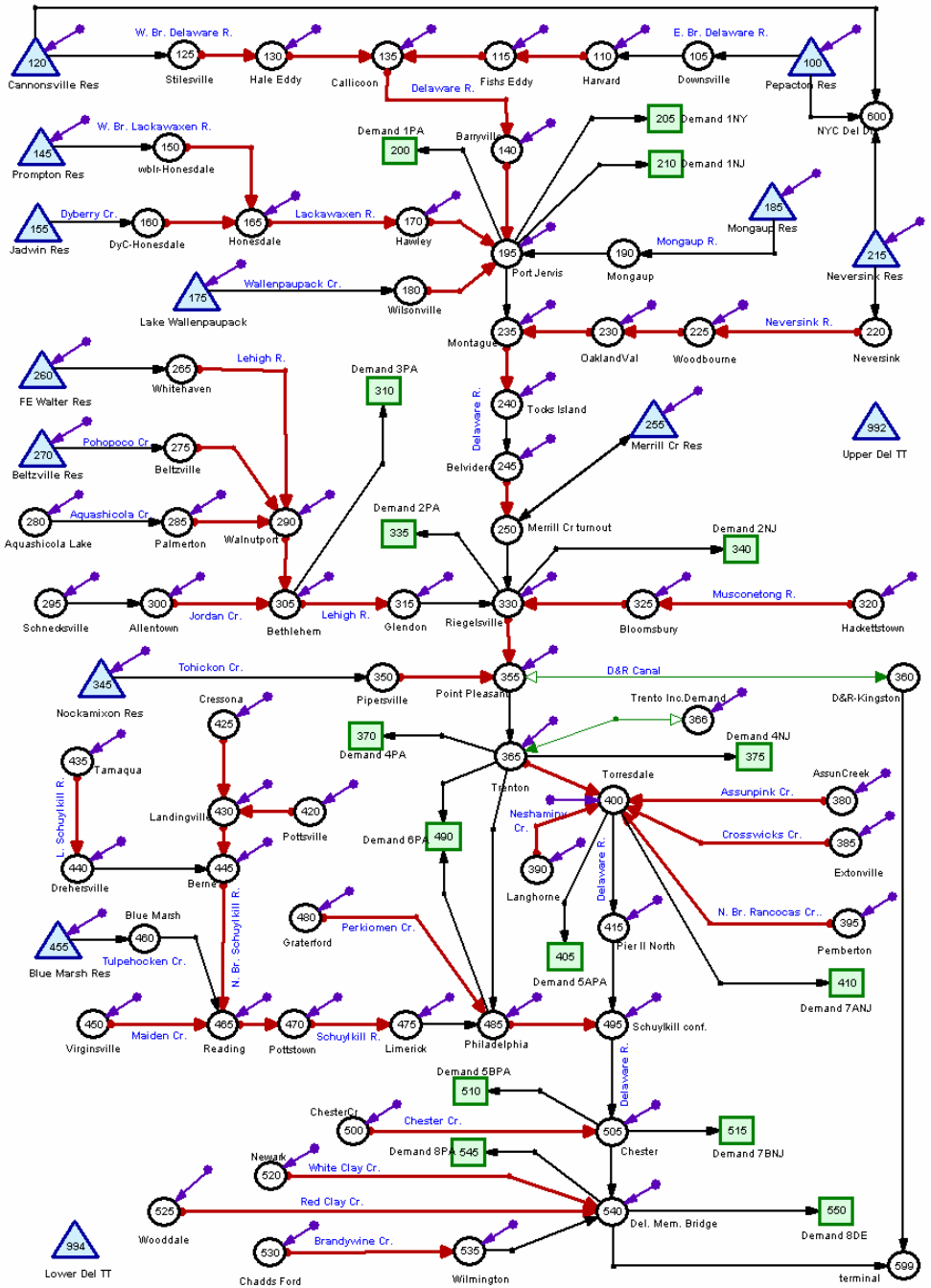
- DRBC funds Flow Management Study and OASIS model development
- TNC and partners present ESWM framework to DRBC and Decree Parties
- Fall 2003, DRBC creates the **Subcommittee on Ecological Flows** to define "ecological flow requirements for the maintenance of self-sustaining aquatic ecosystems" in the Delaware Basin
- Critical recognition of the value of ecological science to water management; central to the policy process without being limited by it

Subcommittee on Ecological Flows: A Focus on Science

- SEF reps: state, NYC, federal, non-profit, and academic technical staff
- SEF goal: to provide ecological information to support major water management policy revision May 2007
- Advisory role, no dedicated funding, TNC acts as chair
- Work to date using federal funding and "volunteer" staff time of SEF membership
- Critical open dialogue with policy-makers from states and NYC

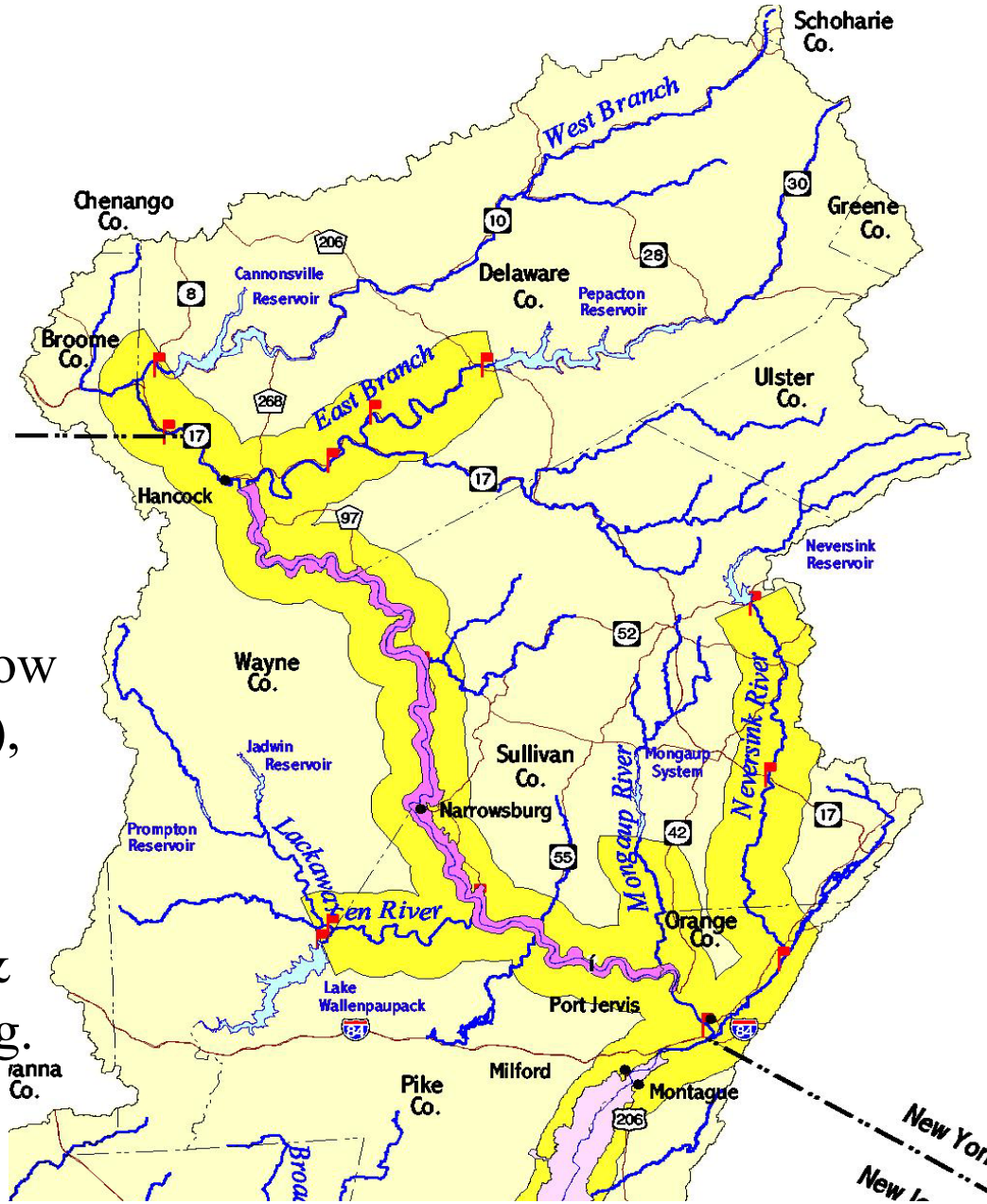
Decision Support Framework

- OASIS model, Hydrologics, Inc.
- Linear programming model that uses hydrologic data and subjects it to a set of constraints and goals (e.g., water policies, flow targets)
- Nodes are used to simulate key basin locations (e.g. diversion pts)
- A set of "flow experiments" created by modifying basin water rules and integrating environmental constraints & goals
- Accepted by all negotiating parties
- Avoids need for precise environmental flow prescription: use flow/habitat performance measures



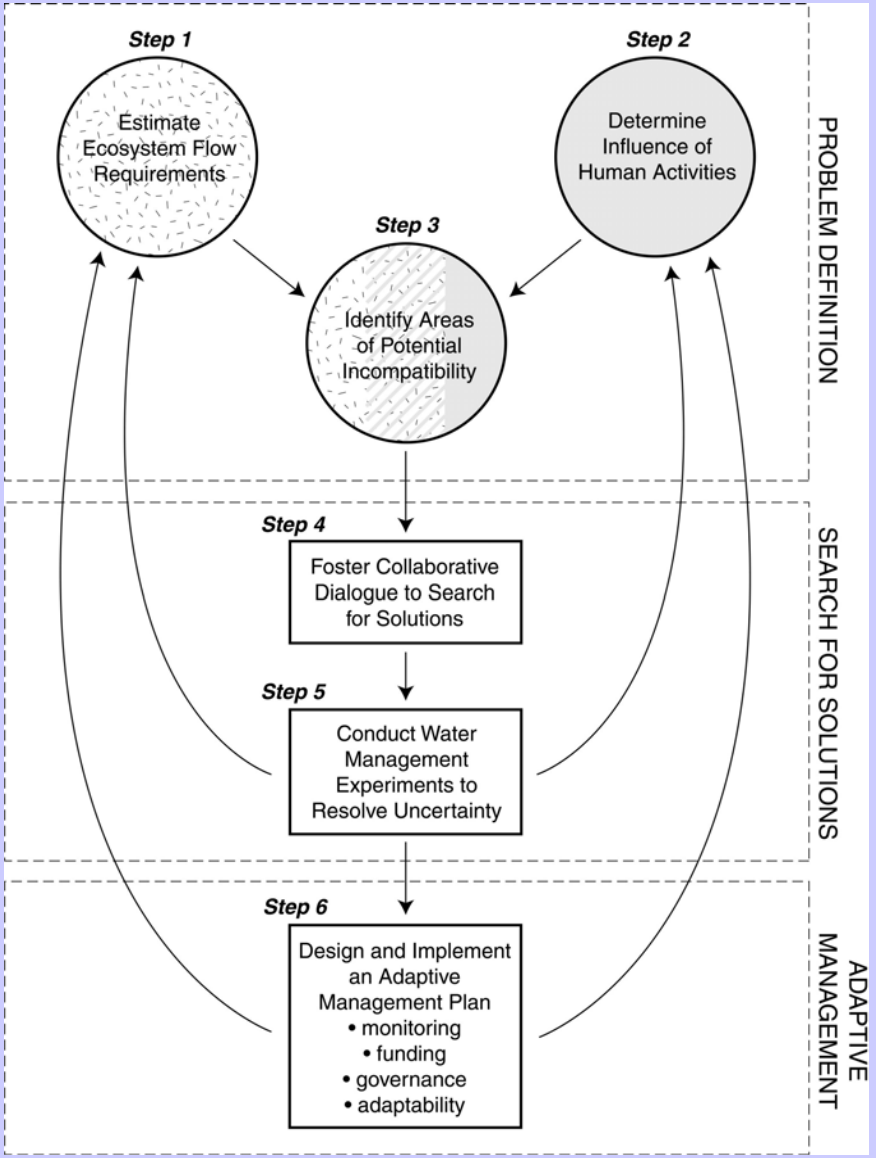
Subcommittee on Ecological Flows: Approach

- A "mitigation" scenario: recognizes high degree of system alteration and lack of appropriate reference conditions
- Focus on Upper Delaware: most difficult to resolve, yet will incorporate lower basin issues
- Using a mix of environmental flow methodologies: hydrologic (RVA), habitat simulation, and aspects of holistic methodologies
- Focus on target species, guilds & associations in study segments (e.g. shad, mussel assemblage, trout)



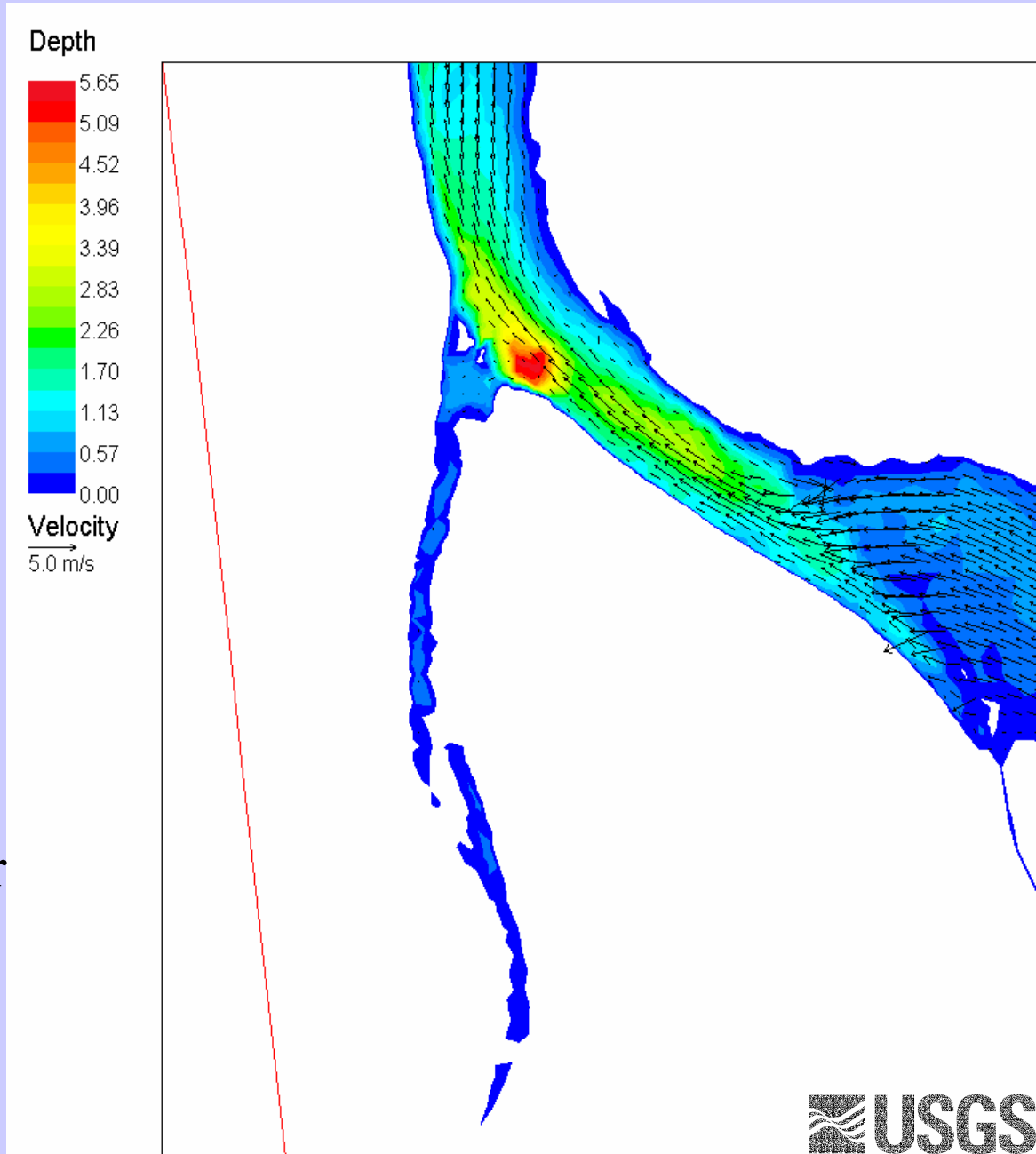
Adaptive Management: A Foundation for Policy Change

- Interim policy (May 2004-May 2007) designed to increase baseflows, limit drought impacts
- Incorporates 3 year monitoring study using baseline fishery and macroinvertebrate data
- Begins an adaptive management loop
- Analysis of existing data brings up key question of detecting statistically significant change for adaptive management



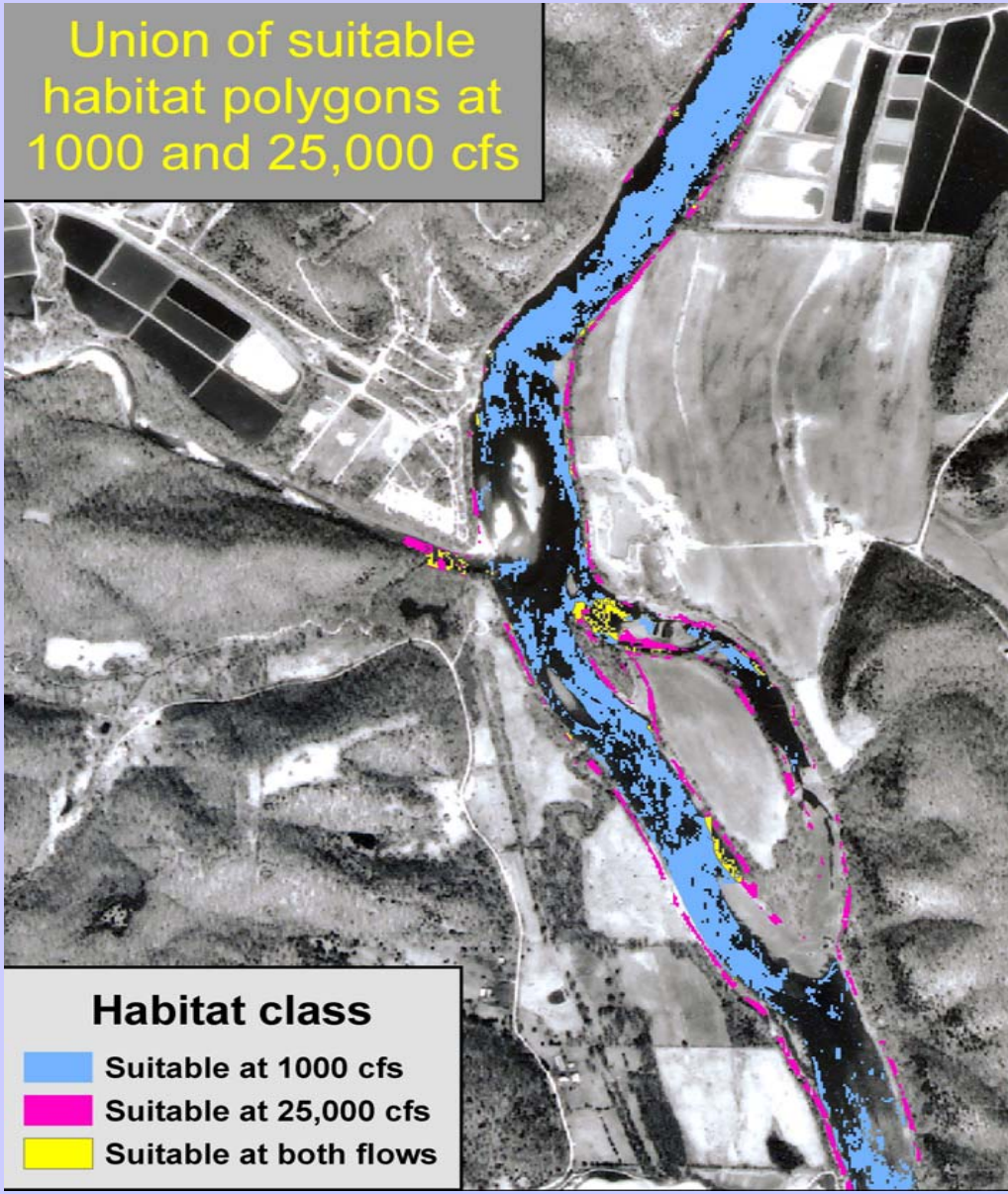
USGS-FORT 2-D Modeling Study

- Surveying segments of three tailwaters and upper mainstem
- Target species and assemblages vary by study area (e.g. trout, American shad, shallow-fast guild, mussel assemblage)
- Seasonal habitat criteria for study targets based on literature and limited field work
- Habitat-flow functions for target species, guilds will be examined at multiple flow levels



Applications of USGS Study

- Model will examine persistence of suitable local habitat conditions at dwarf wedgemussel sites
- Should integrate information from a SNTEMP river temperature model currently under development
- Flow-habitat relationships that result will be used to shape and evaluate flow scenarios for trade-off analysis in OASIS



USGS

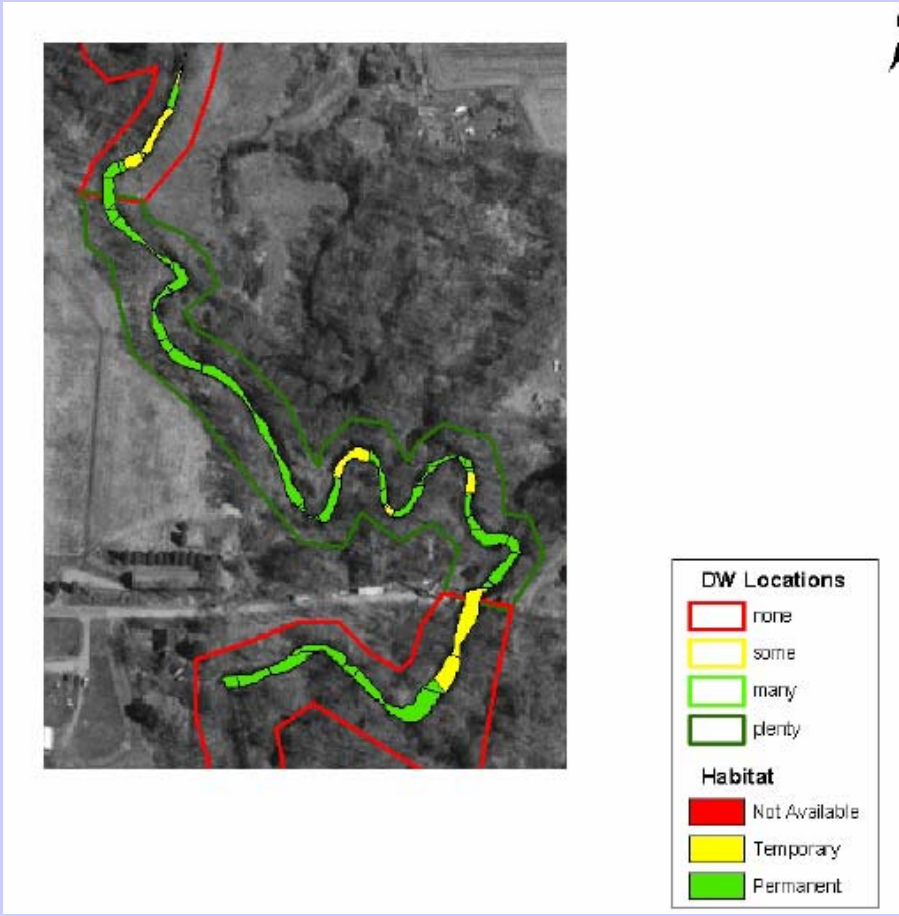
MesoHABSIM- Dwarf Wedgemussel Habitat Studies

• USFWS-NPS-Corps sponsored study using MesoHABSIM approach (Parasiewicz, 2001)

•Delaware mainstem focus

• Mesohabitat types defined by hydromorphological unit, hydraulic and cover assessment – mapped over multiple flow conditions

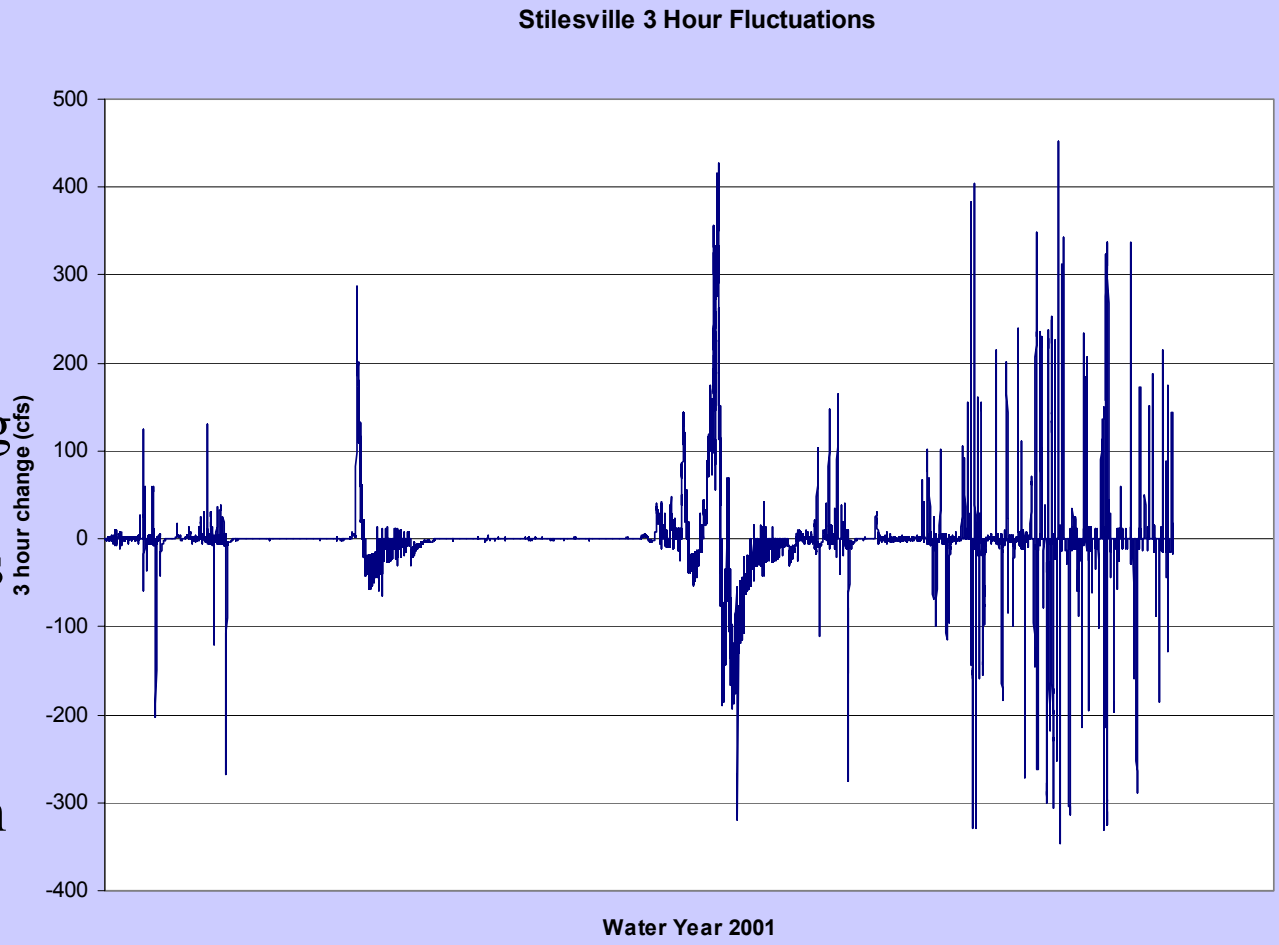
• Habitat response models for dwarf wedgemussel to be created from logistic regression analysis of habitat parameters from other dwarf wedgemussel sites



• To be integrated with intensive microhabitat scale study reaches of USGS and U. Maryland as well as UMASS thermal infrared imagery

Rate-of-change In Flow Issue: Unintended Consequences of a Downstream Flow Target

- Rapid change rate with likely impacts on migratory fish, mussels, and juvenile fish
- Improved guidelines: 310cfs/3hrs increasing 100cfs/hr decreases but all in first 5-10 mins.
- SEF and NYC refining recommendations, seeking smaller and less rapid “steps” at flows near seasonal baseflow
- Additional research on the topic needed for policy

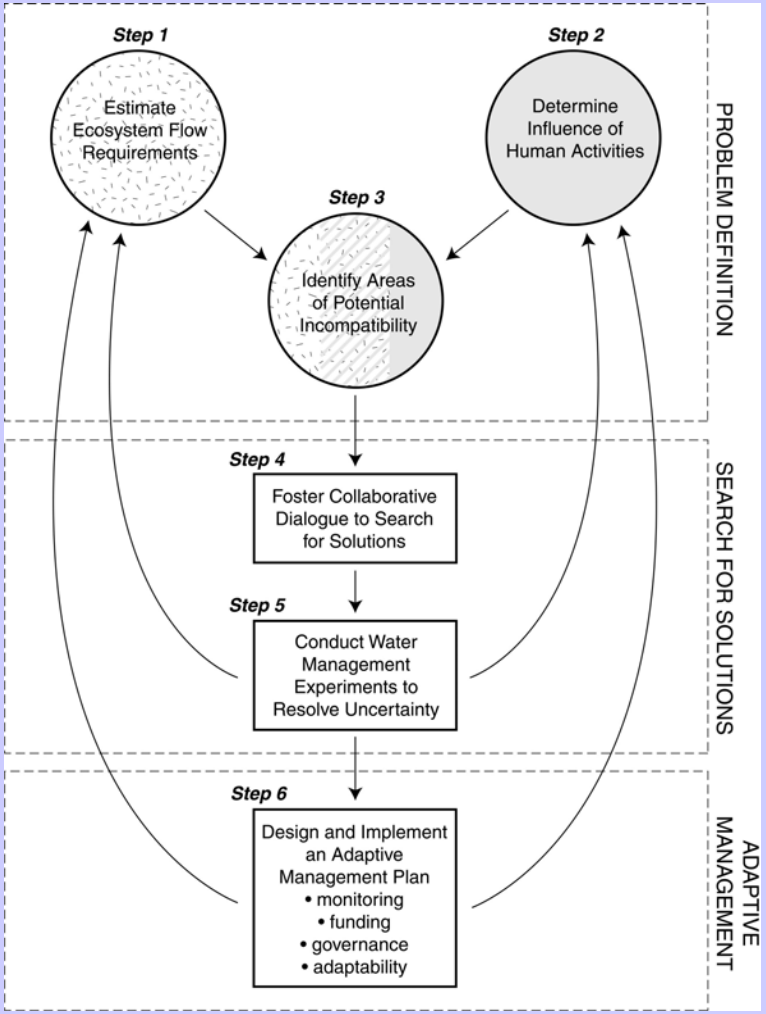


Delaware Basin Eco-Flow Efforts

- Estuary inflow requirements to be examined using salinity relationships
- Seeking funding for assessment of flow relations with riparian veg, macrophyte, & sediment dynamics
- Final ecological criteria must include expert workshop input and attention to inter and intra-annual flow variability
- USGS and NJ DEP leading on a hydrologic regime protection approach that could be applied in basin tributaries
- PA DEP working on water budgets: instream flow needs must be included

Interstate Flow Management: Data and Process Needs

- NYC & Basin States in process of setting boundaries for negotiation of basin water management rules
- Adaptive management will need to be a centerpiece of any agreement
- DRBC a crucial venue for negotiations; USGS science support critical
- Need empirical stressor-response relationships between alteration of flow components & ecological integrity indicators



The Future of the Delaware Basin Water Management

- Political obstacles of interstate flow management balanced by opportunities for progress in revision of Supreme Court Decree
- Delaware Basin Plan sets goals related to defining water budgets, instream flow needs, groundwater availability, and ecological impacts of hydrologic alteration
- DRBC and states are interested in defining natural hydrographs and relating alteration to ecological health

Photo by Bill Schick

- USGS and partners can provide decision-makers the scientific tools necessary to strike the balance between ecological and human needs